

B. Amendments to the Claims

The following is a complete listing of all claims (including claims being currently amended as well as claims not being amended). The status of each claim is indicated in a parenthetical expression after the claim number.

1. (Currently Amended) A method of identifying a defect in a semiconductor wafer, the method comprising:
- for 11/21/03*
- applying heat to a conductive structure formed on said semiconductor wafer, *10.6*
- said conductive structure being periodic in space along a direction;
- measuring a signal indicative of temperature of a portion of the conductive structure heated by conduction of the applied heat therethrough, thereby to obtain a measurement;
- repeating the act of measuring at each of a number of different locations on the conductive structure, thereby to obtain a plurality of measurements, wherein said locations are along said direction; and
- determining ~~presence~~ absence of the defect in the conductive structure, *Spec*
- depending on finding periodicity in the plurality of measurements, wherein said periodicity is related to periodicity of the conductive structure.
2. (Original) The method of Claim 1, wherein:
- a laser beam is used during said applying of heat;
- reflection of another laser beam is measured during said measuring; and
- the laser beams are scanned together during said measuring.
3. (Original) The method of Claim 2, wherein:
- the laser beams are coincident, thereby to form a single spot on the conductive structure.
- Consistency?*

SILICON VALLEY
PATENT GROUP LLP

2350 Mission College Blvd.
Suite 350
Santa Clara, CA 95054
(408) 982-8210
FAX (408) 982-8210

4. (Original) The method of Claim 1, wherein:
the conductive structure has at least one dimension less than 1 μm .

5. (Original) The method of Claim 1, wherein:
an electron beam is used during said applying of heat.

6. (Original) The method of Claim 1, wherein:
a thermal imager is used during said measuring.

Claim 7 (canceled).

8. (Currently Amended) The method of Claim 7 1, wherein:
said determining includes using a transform of said plurality of measurements,
said transform converting said plurality of measurements from a spatial domain into a
frequency domain.

9. (Currently Amended) The method of Claim 7 1, wherein:
said determining includes identifying a frequency component not found in a
corresponding plurality of measurements from a reference wafer.

10. (Currently Amended) The method of Claim 7 1, wherein:
said determining includes comparing a curve defined by said plurality of
measurements to a reference curve defined by a corresponding plurality of
measurements from a reference wafer.

11. (Currently Amended) The method of Claim 7 1, wherein:
said determining includes comparing a curve defined by said plurality of
measurements to a baseline.

SILICON VALLEY
PATENT GROUP LLP

2150 Mission College Blvd.
Suite 300
Santa Clara, CA 95054
(408) 982-8200
FAX (408) 982-8210

12. (Currently Amended) The method of Claim ~~7~~ 1, wherein:
a measurement is performed at least at a plurality of vias located sequentially one after another in said direction.
13. (Currently Amended) The method of Claim ~~7~~ 1, wherein:
a pump beam is incident on a first trace in the conductive structure during said applying; and
a probe beam is incident on a second trace in said conductive structure during said measuring; and
wherein said first trace is coupled to said second trace through at least one via.
14. (Currently Amended) The method of Claim ~~11~~ 13, wherein:
each of said first trace and said second trace are in a single metal layer.
15. (Currently Amended) The method of Claim ~~11~~ 13, wherein:
each of said first trace and said second trace are in different metal layers.
16. (Original) The method of Claim 1, wherein:
said determining includes comparing the plurality of measurements to a corresponding plurality of measurements obtained from a reference wafer.
17. (Original) The method of Claim 1, wherein:
said repeated acts of measuring are performed while moving a stage carrying the semiconductor wafer containing the conductive structure; and
performing said measuring continuously, thereby to obtain an analog signal;
and
using said analog signal during said determining.

B1
called

SILICON VALLEY
PATENT GROUP LLP
2350 Mission College Blvd.
Suite 300
San Jose, CA 95128
(408) 982-8210
FAX (408) 982-8210

B1
Cont'd

18. (Currently Amended) A method for determining the quality of a first conductive structure, the method comprising:
applying heat to the first conductive structure using a modulated heat source,
said first conductive structure being periodic in space along a direction;
measuring a first phase difference between temperature change of said first conductive structure and modulation of said heat source; and
analyzing whether said phase difference is larger than a second phase difference, said second phase difference being detected with a second conductive structure that is non-defective, to determine quality of said first conductive structure.

19. (Original) The method of Claim 18 wherein reflection of a laser beam is used to measure the phase difference.

20. (Currently Amended) The method of claim 18 wherein said quality is related to a defect in said first conductive structure.

21. (Original) The method of Claim 20 wherein said defect is any defect in a group consisting of voiding, narrow trace, and misalignment of a via to a trace.

22. (Currently Amended) A method for determining the quality of a conductive structure, the method comprising:

applying heat to the conductive structure using a modulated heat source,
wherein said conductive structure comprises a plurality of via chains, and the heat is applied simultaneously to more than one via chain;

varying the frequency of modulation of said heat source;

measuring a change in temperature of said conductive structure, as a function of the frequency of modulation; and

SILICON VALLEY
PATENT GROUP LLP
2550 Mission College Blvd.
Suite 260
Santa Clara, CA 95054
(408) 982-8200
FAX (408) 982-8210

analyzing said function to determine the quality of said conductive structure.

23. (Original) The method of Claim 22, wherein reflection of a laser beam is used to measure the temperature change.

24. (Original) The method of Claim 22, wherein heat is applied to said conductive structure using a laser beam.

25. (Original) The method of Claim 22 further comprising:
repeating the act of measuring at each of a number of different locations on the conductive structure, thereby to obtain a plurality of measurements; and
using said plurality of measurements during said analyzing.

26. (Original) The method of Claim 22 further comprising:
moving a stage carrying a semiconductor wafer containing the conductive structure at a fixed speed; and
performing said act of measuring continuously, thereby to obtain an analog signal; and
using said analog signal during said analyzing.

27. (Original) The method of Claim 22 wherein said analyzing comprises:
identifying irregular features in the conductive structure.

28. (Currently Amended) An apparatus for identifying a defect in a conductive structure, the apparatus comprising:
a laser for applying heat to the conductive structure, the conductive structure being periodic in space along a direction ;

SILICON VALLEY
PATENT GROUP LLP

2350 Mission College Blvd.
Suite 360
Santa Clara, CA 95054
(408) 982-8210
FAX (408) 982-8210

a sensor for measuring a signal indicative of temperature of a portion of the conductive structure heated by conduction of the applied heat therethrough, at a number of different locations on the conductive structure, thereby to obtain a plurality of measurements, wherein said locations are along said direction; and

means for determining presence of the defect in the conductive structure, based on finding aperiodicity in the measured temperature plurality of measurements.

29. (Previously Amended) The apparatus of Claim 28, wherein said sensor for measuring comprises a thermal imager.

30. (Previously Amended) The apparatus of Claim 28 wherein said means for determining comprises a personal computer.

*B1
could*

[Please add the following new claims.]

31. (New) The method of Claim 1 wherein:
a spatial frequency of the plurality of measurements is equal to inverse of the periodicity of the conductive structure.

32. (New) A method of identifying a defect in a semiconductor wafer, the method comprising:

using a first beam to apply heat to a conductive structure formed on said semiconductor wafer, the conductive structure being periodic in space;

using a second beam to measure a signal indicative of temperature of a portion of the conductive structure heated by conduction of the applied heat therethrough, thereby to obtain a measurement;

SILICON VALLEY
PATENT GROUP LLP

2350 Mission College Blvd.
Suite 360
Santa Clara, CA 95054
(408) 982-8210
FAX (408) 982-8210

BI
end

repeating the act of measuring at each of a number of different locations on the conductive structure, thereby to obtain a plurality of measurements; and
determining presence of the defect in the conductive structure, depending on spatial periodicity of the plurality of measurements;
wherein the first beam and the second beam are at least partially coincident.

33. (New) The method of Claim 32 wherein:
the first beam and the second beam are perfectly coincident, thereby to form a single spot on the conductive structure.

34. (New) The method of Claim 18 wherein:
the heat source is modulated at a frequency selected to be sufficiently low to prevent generation of a thermal wave.

SILICON VALLEY
PATENT GROUP LLP

2350 Mission College Blvd.
Suite 300
Santa Clara, CA 95054
(408) 982-8210
FAX (408) 982-8210